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The Brunswick Society

Newsletter

Vol. 30, Nov. 2015



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Editorial staff:

Kaufmann, E., Athanasou, J. A., & Hamm, R. M.

Contact:

The Brunswik Society Newsletter

c/o University of Zurich

Institute of Education, University of Zurich,

Kantonsschulstr. 3

CH-8006 Zurich

Switzerland

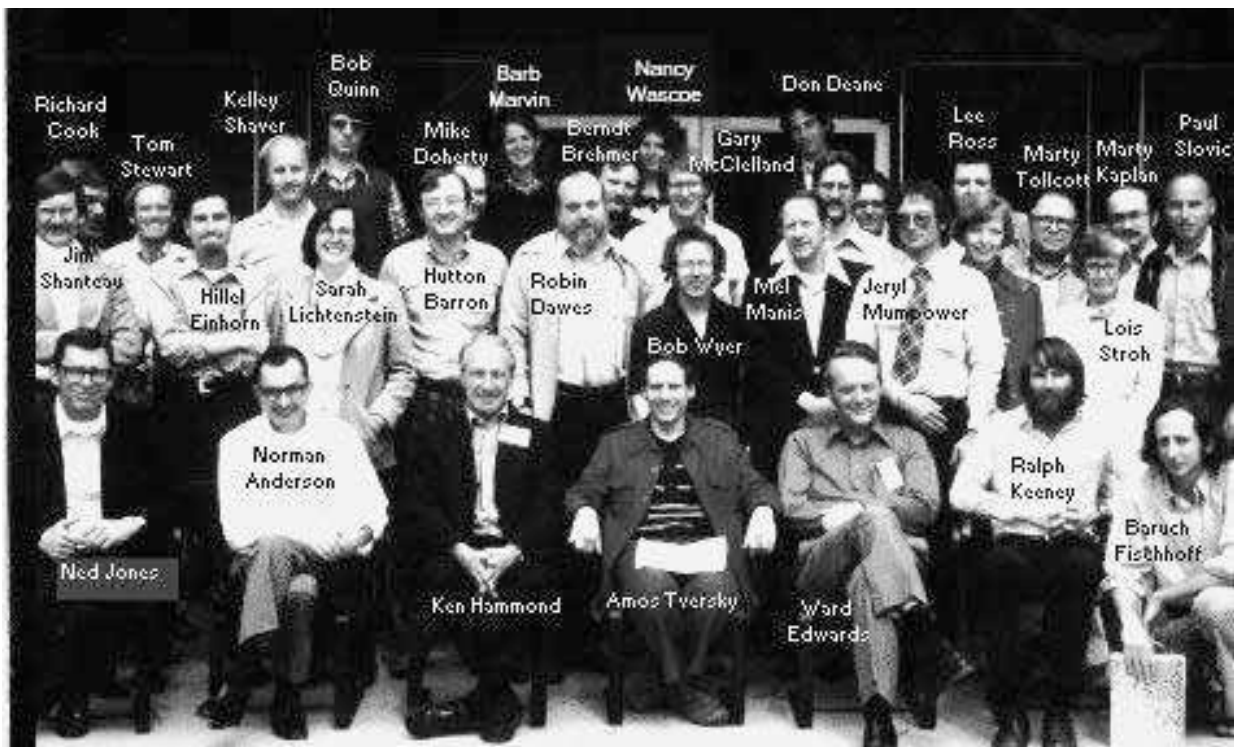
Foreword

This newsletter is dedicated to Kenneth R. Hammond (1/13/1917 – 4/28/2015), the founder of the Brunswick Society.



Kenneth R. Hammond at the Brunswick Society Meeting 2004.

Hammond was the first person to transfer Brunswik's research to judgment and decision-making. He vigorously promoted this perspective, and organized several conferences gathering researchers with common interests, some in Boulder (see the photograph below), and one as a lunch at an APA meeting (1981, Los Angeles). He welcomed the founding of the Society for Judgment and Decision Making (1981), and encouraged the organizers to leave plenty of space in the schedule for people to discuss informally. He served as the second president of SJDM. In 1985 he organized the first meeting of the Brunswick Society, to allow more focus on the themes and methods of Brunswikian research.



Hammond's work has inspired many scholars to fruitfully apply Brunswikian ideas to judgment and decision-making in various fields (see Dhami's contribution in this newsletter) and for contributions by his students (see the note by Adelman). Recently, the scientific community has recognized the value of Hammond's concepts of correspondence and coherence. These have been discussed critically and developed further in the submissions from Polonioli and by Dhami.

We see a Brunswick Society Newsletter as an insufficient way to honor Ken Hammond and his lifelong curiosity about judgment and decision-making. We would therefore like to encourage you to initiate Hammond-based research activities such as symposia at conferences or special issues in relevant journals. One journal – the *Journal of Artificial Societies and Social Simulation* – has already expressed interest in Brunswikian research (see the contribution by Thorngate). Hoffrage and Marewski have also recently published Hammond's last article in a special issue at the *Journal of Applied Research in Memory and Cognition*. Please have a look at their article, as there is also a call for commentaries from Brunswikians. We encourage you to take the opportunity to make your opinion known to a wider audience.

This year's Brunswick Society Newsletter also covers other work within the Brunswick framework related to music and sound (Gingras and Ko and Steffens) or measurement topics (Nestler and Oppenheimer).

We hope that the current newsletter additionally inspires further thoughts and research activities which could be reported in the next Brunswick Society Newsletter, in special issues or other outlets. To keep up with the Brunswick Society and the associated newsletter, please sign up for the Brunswick Society mailing list which you will find at www.brunswik.org. We look forward to hearing your thoughts and ideas using this list.

Many thanks to all authors for their contributions!

Sincerely,

Esther Kaufmann, James A. Athanasou and Robert M. Hamm

Thank you to Tom Stewart, the webmaster of the Brunswick Society, for providing web access to the Newsletter.

Contributions

Lessons-Learned Research

Len Adelman

*George Mason University,
USA*

Contact: ladelman@gmu.edu

When I was a graduate student, Ken Hammond routinely told us that people often can't learn from experience (or history). The task is too complex and multi-causal in many environments. Many Brunswikians agree with Ken. Now, we have increasing empirical support from the "evidence-based" research thrust in management, medicine, law enforcement, and other domains showing the inadequacy of many expert practices. Moreover, people are often overconfident that they have learned the correct lessons when things go wrong. The question that my colleagues (Dr. Paul Lehner and Dr. Lynn Cooper) at the MITRE Corporation and I have been addressing is, "Do methods differ in reducing people's overconfidence that they have learned the correct lesson when projects fail?"

We investigated two methods for reducing overconfidence: (1) listing alternative causes (in addition to the stated "lesson-learned") for a negative project outcome, and (2) describing a counterfactual project history; that is, asking what if the identified lesson actually had been implemented and resulted in either a positive or negative outcome. These methods were selected because they are used in lesson-learned interviews, albeit in an ad hoc manner, and because empirical research has found them successful in reducing overconfidence. The participants were employees in a systems-engineering, research and development corporation. They applied the methods to actual projects that failed in a critical way.

As hypothesized, asking people to think about alternative causes for the failure significantly reduced participants' mean confidence in their "lesson learned." In contrast, and contrary to our hypothesis, asking people to think of a counterfactual history that would have resulted in a positive outcome either had no effect or significantly increased participants' confidence. We had thought that people would naturally think of how things could go wrong when they thought of how they could go right. We were wrong. The counterfactual history method only significantly reduced participants' mean confidence in their lesson when they explicitly thought of how it could result in a negative outcome.

What and how one asks about "lessons learned" can lead to significantly different assessments. But perhaps this would not have surprised Ken, given the nature of the task.

Reporting Evidence from the Analysis of Mental Operations in the Item Response Process – Looking for Brunswikian Symmetry

Sebastian Brückner

Johannes Gutenberg-University Mainz, Germany

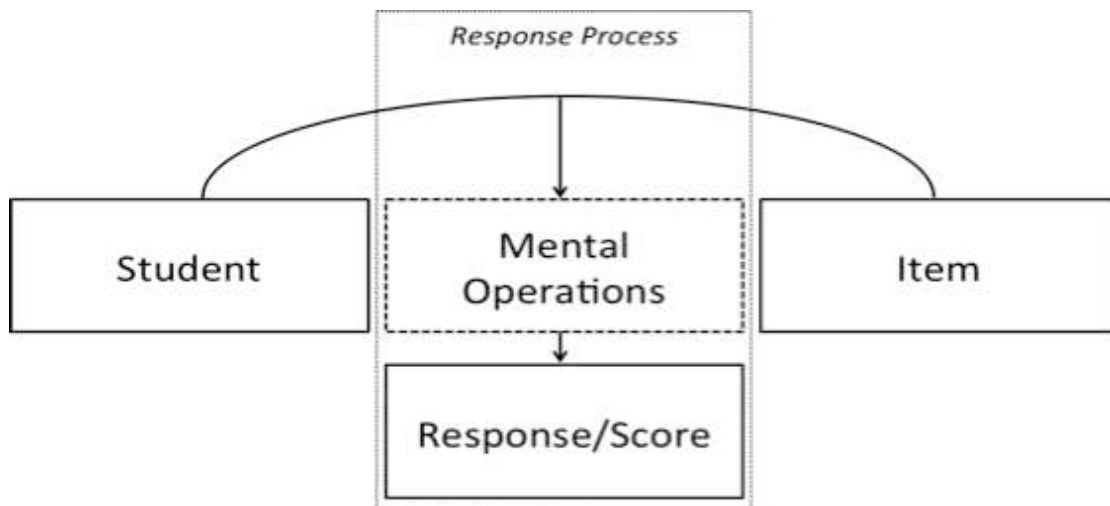
Contact: brueckner@uni-mainz.de

For many years, the Standards for Educational and Psychological Testing (AERA, APA & NCME, 2014) have claimed that it is necessary to analyze students' response processes in standardized educational assessment. When students respond to standardized achievement tasks, they use different kinds of mental operations (e.g., analogical or deductive reasoning, elaboration of knowledge). The main objective of this response process analysis (AERA et al., 2014) is to assess, describe, structure, and compare these mental operations to theoretical assumptions and to correlate them with input variables (e.g., students' sociodemographic features) and output variables (e.g., item and test scores) that are usually examined in assessments.

However, in various educational study domains, mental operations are only rarely defined in task performance models (Leighton, 2004) or cognitive diagnostic models (Rupp, Templin, & Henson, 2010) and also are rarely empirically examined (e.g., using the think aloud method); for various frequently discussed reasons for this lack of research, see e.g., Brückner & Kuhn, 2013; Leighton, 2004). Furthermore, it is often not clear how these mental operations should be connected with other kinds of validity evidences recommended by the Standards (e.g., evidence from expert interviews or evidence from test models like IRT Models).

The work of Brunswik (1952, 1957) gives an indication regarding the role of mental operations in assessments and how other kinds of evidence can be linked to these operations according to the Standards. When he states that psychology is focused on "interrelationships between organism and environment", it comes to mind that mental operations could be considered the result of an interrelation or interaction as well (e.g., Pellegrino, Baxter, & Glaser, 1999). In this context, students are the organisms and the items are the environment students have to cope with. The result of this interaction is the mental operations that lead to item responses (illustrated in the following figure).

Since responding to an item can also be considered as making a decision, the symmetry (Wittmann, 1988; 2002) of the Brunswikian lens model offers a number of possibilities on how to analyze mental operations that should be equally affected by both student and item characteristics. For example, if a student knows about the economic concept of altruism and is expected to solve an item that requires knowing this concept, then the mental operation should not be distorted by item features (e.g., item difficulty, item format or ratings from experts), but should equally support the memorization of this concept.



Thus, when mental operations are analyzed, both perspectives should always be explored and the correlations should be compared. Brunswik's metaphor (1957, p. 5) that both the organism and the environment should be compared to "a married couple" with mental operations as their children can be expanded to illustrate that, in similar situations (e.g., when the child has broken a vase), both parents should ideally treat the child (the mental operations) in the same way (e.g., both parents might be angry in a similar way instead of one praising and the other reprimanding the child).

Empirically this means that the symmetry must be analyzed using correlation or regression analyses (Wittmann, 2002). In an assessment, several criteria of the environment (items) and organisms (students) are included and therefore a nested structure of the data becomes evident that can be analyzed from both sides (e.g., if mental operations are nested within items or students) using generalized linear multilevel models (an empirical example is given in Brückner and Pellegrino, in review).

The implication for current validation standards is that analyses of mental operations and item scores should not focus exclusively on student characteristics, but should also take into account item characteristics. In my current work (Brückner, in press; Brückner & Pellegrino, under review) I take into account the idea that mental operations are situation-specific – which is also reflected in the currently discussed socio-cognitive paradigm (Mislevy & Durán, 2014) – and that they must be analyzed reflecting the aspects of a symmetry (Wittmann, 1988; 2002). Thus, the comparison of the results from both models should increase the credibility of findings from mental operations when a symmetrical structure is found. The idea that mental operations are not only a deductive result from student thinking, but rather should be treated as an actively constructed process that arises from the interaction of student and item features is important for future validation studies.

Finally, this work is included in my recently finished PhD-thesis (see Brückner, in press). Questions and recommendations are welcomed.

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Ken and I

Madeep K. Dhami

Middlesex University, London, UK

Contact: m.dhami@mdx.ac.uk

My first contact with Ken was over email in 1996, when I started my PhD. I had read his early work with great interest and was left wondering why it was so important to use an idiographic approach to understanding human behavior, given that most of psychology used a nomothetic approach. Ken soon made it clear why(!) and I proceeded to study legal decision-making at the individual-level for my PhD.

I next met Ken in person in the 1997 Brunswik Meeting in Philadelphia. His vision for how human judgment and decision-making (*JDM*) should be studied was clear, his constructive critique of alternative (accepted) approaches in *JDM* was convincing, and his wide-ranging knowledge of the behavioral sciences (including the history of science) was impressive. He was a magnet for those of us who wanted to know more about the life and work of Egon Brunswik, and to learn about how Brunswikian ideas could be interpreted and applied.

Over the past two or so decades, I had the pleasure of engaging with Ken on numerous occasions. Beyond the “advice” he offered with regard to planning each year’s Brunswik Society meetings, we spoke about our respective research. He provided feedback on my manuscripts and I on his. We often talked about collaborating on a project and once we did start a paper, only to soon realize that we did not agree on some of the fundamentals. I questioned his depiction of “quasi-rationality” and naively asked him to differentiate it from a concept used by Kahneman and Frederick. Ken and I didn’t speak for a while after that “heated” exchange – although he continued to write wonderful letters of reference for me as I moved forward in my academic career.

As a student of Brunswik, Ken had applied Brunswikian ideas to the study of clinical judgment (Hammond, 1955), multiple cue probability learning (Hammond & Summers, 1965), cognitive feedback (Todd & Hammond, 1965), interpersonal conflict (Hammond, 1965, 1973; Hammond, Todd, Wilkins, & Mitchell, 1966) and interpersonal learning (Hammond, 1972; Hammond, Wilkins, & Todd, 1966). Then, in 1975, he synthesized this work and developed social judgment theory (Hammond, Stewart, Brehmer, & Steinmann, 1975). He had achieved so much so early, and yet he continued. Notably, Ken proposed cognitive continuum theory (Hammond, 1996, 2000).

Ken’s passionate, albeit sometimes despairing manner, served to enthuse me; making me feel like I could make a difference and that much work was yet to be done. Below, I provide the abstract for a paper I published this year on quasi-rationality – I think Ken would have approved. I shall miss him.

Dhami, M. K., Belton, I., & Goodman-Delahunty, J. (2015). Quasi-rational models of sentencing. *Journal of Applied Research on Memory and Cognition*, 4, 239-247.

Abstract: Cognitive continuum theory points to the middle-ground between the intuitive and analytic modes of cognition, called quasirationality. In the context of sentencing, we discuss how legal models prescribe the use of different modes of cognition. These models aim to help judges perform the cognitive balancing act required between factors indicating a more or less severe penalty for an offender. We compare sentencing in three common law jurisdictions (i.e., Australia, the US, and England and Wales). Each places a different emphasis on the use of intuition and analysis; but all are quasirational. We conclude that the most appropriate mode of cognition will likely be that which corresponds best with properties of the sentencing task. Finally, we discuss the implications of this cognition-task correspondence approach for researchers and legal policy-makers.

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**Cue Redundancy in the Communication of Musical Emotions:
The Case of Sound Intensity**

Bruno Gingras
*University of Innsbruck,
Austria*

Contact: brunogingras@gmail.com

Music is generally recognized as a potent inducer of emotions in everyday life (Sloboda, 2010). Two theoretical models are frequently applied to the communication of musical emotions: the Brunswik lens model, first applied to music by Juslin (1995), and the cue-redundancy model (Balkwill & Thompson, 1999). Both models predict that musical emotions are encoded by a large number of partially redundant auditory cues that can be used flexibly. Based on these models, the emotional information encoded by one acoustical parameter may also be carried, at least in part, by other acoustical features.

We sought to test two hypotheses that follow from the Brunswik lens and cue-redundancy models by comparing the emotional ratings obtained on a large set of musical excerpts and on an identical set that was normalized for sound intensity (amplitude normalization). Intensity is a basic acoustical cue signaling emotional and motivational states in humans and animals. As such, sound intensity is recognized as one of the most reliable predictors of both speech- and music-induced arousal (Ilie & Thompson, 2006; Scherer, 1989). However, based on the Brunswik lens and cue-redundancy models, we hypothesized that other acoustical features besides intensity could be effective predictors of music-induced arousal for both original and amplitude-normalized excerpts. Additionally, we predicted that the emotional ratings of amplitude-normalized excerpts should not differ significantly from those obtained on the original versions of these excerpts, because other acoustical cues, partly redundant with intensity, would convey the information carried by variations in intensity. The latter prediction was further supported by Juslin's (2001) observation that acoustical parameters often covary in music performance.

We adopted Russell's (1980) circumplex model of affect, which situates emotions in a two-dimensional space defined by energy arousal and pleasantness (valence), and selected musical stimuli varying along these dimensions. Our stimuli consisted of eighty-four 6-second representative excerpts from Romantic (early to middle 19th-century) piano trios. We used only one excerpt per movement to avoid intra-opus familiarity effects, and we chose excerpts with uniform emotional expression. Mean root-mean-square energy equalization was used to obtain the amplitude-normalized excerpts.

Sixty psychology students at the University of Vienna, with less than three years of musical training and not musically active at the time of the experiment, were invited to participate in our study. Thirty participants rated the original excerpts, whereas another 30 participants rated the amplitude-normalized excerpts. The two groups were balanced for gender and matched for age. Participants were asked to

rate each excerpt on a 7-point scale for familiarity (“very unfamiliar” to “very familiar”), felt arousal (“very calm” to “very aroused”), and felt pleasantness (“very unpleasant” to “very pleasant”). Excerpts were played on headphones at a comfortable fixed intensity level. The order of presentation of the excerpts was randomized, and there was a 5-second delay between successive excerpts.

We conducted the sound analysis using Praat (Boersma & Weenink, 2009) and the MIR Toolbox in MATLAB (Lartillot, Toivainen, & Eerola, 2008) and investigated acoustical features comprising four domains: dynamics, sound spectrum, rhythm, and tonality. In total, we computed the values of 21 features for each excerpt and then conducted regression analyses, using a stepwise-forward procedure, to predict the arousal and pleasantness ratings based on acoustical features (4 parameters with high collinearity were excluded from the analyses). Because familiarity is known to influence emotion ratings, we excluded 4 excerpts whose familiarity ratings were higher than 4 (the middle of the scale), leaving 80 excerpts to be analyzed.

Regarding our hypothesis that other acoustical features besides intensity should predict the variation in arousal ratings between excerpts, the regression analysis showed that two features related to the sound spectrum, spectral flux and spectral entropy, accounted for 65% of the variance in arousal ratings for both original and amplitude-normalized sets. Thus, although intensity was the most important predictor of arousal for the original set, arousal ratings were effectively predicted by spectral features in the absence of intensity cues.

With respect to our hypothesis that emotional ratings should not differ significantly between both sets of excerpts, we found a high correlation between the original and amplitude-normalized sets for mean arousal ratings ($r_s = .84$, $p < .001$), and a slightly lower one for pleasantness ($r_s = .69$, $p < .001$). Furthermore, an analysis of the Procrustean fit between the two-dimensional emotion spaces associated with the original and amplitude-normalized sets yielded a high correlation of .80 ($p < .001$). To summarize, arousal and pleasantness ratings were highly correlated between both sets and the emotion spaces for both sets were similar, thereby corroborating our second hypothesis.

Overall, our results indicate that musical emotions are conveyed by several acoustical cues that may be partially overlapping. These findings, which are consistent with both the cue-redundancy and Brunswick lens models, suggest that music is a robust communication system which uses redundancy to augment its versatility and efficacy.

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The present article is a summary of the following:

- Gingras, B., Marin, M. M., & Fitch, W. T. (2014). Beyond intensity: Spectral features effectively predict music-induced subjective arousal. *Quarterly Journal of Experimental Psychology*, 67(7), 1428-1446. doi: 10.1080/17470218.2013.863954.

Investigating the Nutritional Value of Packaged Foods: Brunswick Lens Model Analyses

Claudia González-Vallejo
Ohio University, USA

Contact: gonzalez@ohio.edu

Consumer judgment of the nutritional value of food products is increasingly pertinent as obesity and nutritionally-related illnesses remain at record levels in developed nations. The U.S. 1990 Nutritional Labeling and Education Act standardized a nutrition label (the Nutrition Facts Panel, or NFP) with the goal of helping consumers to make better judgments. However, the degree to which consumers use the NFP to judge the nutritional quality of foods and make efficient choices is not well understood. We have started a line of research on nutrition judgments of packaged foods that uses the Lens Model as a framework. First, our recent study (Gonzalez-Vallejo & Lavins, 2015) demonstrated that US consumers' judgments of nutrition of cereals based on NFP information was in ordinal agreement with a nutrition profile scoring system NuVal®. NuVal is a nutrition expert algorithm that rates foods in a scale of 1 to 100 with the top score being the best in nutritional value. We used NuVal as the gold standard to assess nutrition accuracy and to study the patterns of cue usage (nutrients) by participants in relationship to the usage by the NuVal system. Our study also investigated whether higher accuracy would be reached with new proposed FDA labels and found that the current label was as good as or better than the proposals. Two hundred and thirteen adults completed an online survey (66.2% female, mean age 37.31, SD 12.56 years). Judged nutrition quality of cereals was positively correlated with protein, fiber, and potassium and negatively correlated with sugars and sodium. This pattern appeared when using the current NFP or the modified versions. Highlighted nutrients in modified NFP formats did not

affect their perceived importance as intended by FDA. Accuracy of the nutrition quality judgments was highest under the current NFP (Spearman's $\rho = .76$ for the current NFP; .64 and .72 for the other formats). Regression analysis showed that nutrition judgment accuracy increased significantly (adjusted $R^2 = .13$) with obesity knowledge ($\beta = .27$), age ($\beta = .15$) and current NFP ($\beta = .13$).

Another study examined judgments of 196 individuals (MTurk and a student sample) living in the United States (mean age 28, SD = 12 years) who rated the nutritional quality of cereals or snacks. NuVal related differently to nutrients in cereals and snacks with fiber emphasized in both. Negative beta weights were associated with sugar and sodium in cereals. In snacks, there was a negative association with saturated fat and a positive one with other carbohydrates. Judgment consistency was higher when judging cereals (median $R^2 = .6$) than snacks (median $R^2 = .5$). Accuracy showed the reversed pattern with higher achievement index for snacks (median $r_a = .3$) than for cereals ($r_a = .2$). Higher agreement of the judgment policies between person and environment was obtained with cereals (median $G = .5$ for cereals, and $G = .4$, for snacks). No individual level variables related to either consistency or accuracy of the judgments. Current studies continue to explore individual differences that may relate to nutrition judgments and also food choices. The role of front-of-package labels (FOPs) is also under investigation as well as models of attention and choice.

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**Unveiling the Lady in Black:
Brunswikian (and Other) Approaches to Intuition**

Ulrich Hoffrage

University of Lausanne, Switzerland

Julian N. Marewski

University of Lausanne, Switzerland

Contact: Ulrich.hoffrage@unil.ch

In September 2015, the *Journal of Applied Research in Memory and Cognition* (JARMAC) published a special issue on "Modeling and Aiding Intuition in Organizational Decision Making", edited by Julian Marewski and Ulrich Hoffrage (2015a). The issue contained 17 articles – all are open access and can be downloaded at <http://www.sciencedirect.com/science/journal/22113681/4/3>. For an overview and the call for commentaries (deadline for proposals: January 10th, 2016), see the entry of Marewski and Hoffrage (2015b) in this newsletter.

In the present entry, we will give an overview of our introduction to this special issue. We will focus on those parts (and on the discussion of those papers in the

special issue) that are related to Brunswikian approaches. There are three such links to the work of Egon Brunswick: (1) the conceptualization of intuition as inference, (2) the notion of quasirationality, and (3) the methodological imperative of using a representative design when studying intuition where it can be been built, namely in natural environments. In the following, we will heavily cite from this introduction (Hoffrage & Marewski, 2015), albeit without using quotation marks.

Our introduction is, in a way, quite special for a scientific publication. Specifically, we did not shy away from reproducing artworks, from weaving metaphors into the text, and from using a style that is quite unusual for a scientific journal – both personalizing and anthropomorphizing the notion of intuition, replacing the “it” with “she” and turning an “object of inquiry” into a “subject” whom we refer to as the *Lady in Black*.

Our introductory article is divided into 3 major sections (followed by epilogue, acknowledgment, and references). In the first section, entitled “Intuitive and historical accounts of intuition” we look at (1.1) spontaneous answers to the question “What is intuition?” One candidate is that it is a sixth sense, some kind of extrasensory perception, an inner voice through which some supernatural beings – Gods, Angels – speak to us. Another one conceives intuition as some sort of animalistic instinct, and hence also allows animals to have intuitions – maybe even better ones than humans. Staying within the animalistic sphere, but allowing this sphere to enter the human kingdom, one could also conceptualize intuition as an evolutionary remnant of our reptilian brains, an old but fast track on the neuronal highway (or, maybe closely related, to locate it in the Freudian unconscious). Note that these two conceptualizations – intuition as an inspiration, an inner voice, possibly of divine origin or as an animalistic instinct – correspond to models of man and to ideas about our origin: the fallen angel versus the dressed ape, respectively. A third view is that these two conceptions might be just projections, reflecting that there is something we do not know and cannot clearly see. The conclusion of such a skeptical position might be that intuition is, at the end of the day, nothing more than a catch-all category for everything related to cognition that we cannot explain. Bluntly speaking, a label for the black-box – and the home of our Lady in Black. Following this third option, we build on the metaphors of light and darkness and place intuition in the middle, that is, in the twilight, where analytical thinking meets what is coming from our unconsciousness. We introduce the two poles of this spectrum as two eras in history: (1.2) The Enlightenment (promoting rational thinking and analysis) and (1.3) Romanticism (stressing the mystery, emotions, and subjective experiences).

Our second section, entitled “Analysis versus intuition today” is divided into five subsections. We (2.1) discuss the culture of objectivity and the fight against subjectivity with its focus on analysis, objectivity, and quantification. And we point out that (2.2) the rational and analytic approach, pushed forward during the Enlightenment, is often combined with an engineering approach. The idea is that understanding something amounts to being able to construct models of it, which may eventually be implemented in mechanical or electronic devices. This is objectivity and transparency in its purest form and it leads to a thought provoking question: Is it possible to build a machine (or to design software or an expert system) that has intuition? To the extent that intuitions are inferences, the answer must be yes, but what if we conceptualize intuitions as qualia, that is, as subjective experiences – then the answer is no. We continue by (2.3) contrasting Taylorism in the organization of

science with holistic worldviews and discuss how these two approaches relate to intuition. Subsequently, we (2.4) contrast System 1 and System 2 with respect to our question “What is intuition?” If intuitions are understood as instincts or as inferences, we may locate them in system 1. If they are, in the tradition of Gestalt psychology, understood as insights, we argue that they should better be located in system 2. If they are understood as (Divine) inspirations or messengers from that reality the Romanticists were referring to, they would not find a home in the System 1 / System 2 landscape. We conclude this discussion by saying that our dear Lady in Black is with us everywhere and that she may not care how we categorize and label the places where she will whisper to us. In the last subsection (2.5), entitled “dichotomies, definitions, and dialectics”, we ask how analysis and intuition are related to each other. Are these dichotomies opposing each other? Or are they, like yin-yang, intertwined and complementing each other? Or like poles with the potential that something new can emerge in the middle, like virtues between vices (in Aristotle’s Nicomachean ethics)? Or like light and darkness that, together, have the potential to let colors emerge in the twilight (in Goethe’s theory of color that we contrast to the Newtonian approach)? Note that the dialectics between yin and yang and how they interact and influence each other is also reflected in theoretical approaches in psychology – for instance, in Brunswik’s (1952) notion of *quasirationality*, which has been further developed in Hammond’s (1996, 2000, 2010) Cognitive Continuum Theory (see also Dhami & Thomson, 2012). The notion of quasirationality points at a combination of analysis and intuition. It is the mode of cognition in the middle-ground between the two extreme poles. Simon (1987) expressed this idea as follows: “intuition is not a process that operates independently of analysis; rather, the two processes are essential complementary components of effective decision-making systems” (p. 61).

In our third section, entitled “Pictures at an exhibition” we give a guided tour through the articles that we have collected for our exhibition. Here we only give a very brief summary of those papers that are the most closely related to Egon Brunswik. The first subsection (3.1), entitled “Experience, expertise, and environments” contains three articles, all single-authored by distinguished researchers: Gary Klein, James Shanteau, and Kenneth Hammond. These authors leaned back, so to speak, and wrote opinion pieces in which they adopted a wide perspective and reflected upon decades of their own but also others’ thinking, theorizing, and ways to conduct research. As another commonality, their articles focus on experience, expertise, and on the natural environment in which experience can be gathered and expertise can develop. The first variation of this theme we look at has been composed by Gary Klein: Intuition results from experience. Experience, in turn, produces experts. Given repeated exposure to various situations, these experts learned about the statistical structure of the environment, that is, they learned which cues are important and which ones are less so when assessing a situation and when predicting outcomes. The experts learned how these cues inter-correlate, and they learned to distinguish certain configurations of cues – patterns that are meaningful to experts but that novices may not recognize as such. This conceptualization also informed the name of Klein’s account: *the recognition-primed decision model*. Finally, and most importantly, these experts also learned what the best course of action is for which pattern. Accordingly, Klein defines “*intuition as the way we translate our experience into action*”. In his article, Klein (2015) describes the naturalistic decision making approach to intuition and contrasts it with two other

frameworks, namely the fast-and-frugal heuristics and the heuristics-and-biases research program. In his article, Klein offers seven suggestions for theory construction and research practice resulting from his synopsis of these three different approaches.

Based on his rich experience from studying experts, James Shanteau (2015) focuses on a puzzle that is related to the experience of these experts. If experts in the same field share similar experiences and if intuition is based on experience, then these experts should develop similar intuitions and they should generally find themselves in agreement with each other. Shanteau provides a brief overview of the literature that speaks to this question and concludes that this is, indeed, often the case – but that there are also many studies that report the opposite. He discusses this heterogeneous pattern and explains the variation in terms of differences between the domains in which the experts gathered their experiences and developed their intuitions. Whether intuitions are good and whether experts develop the same intuitions depends not only on the experts themselves, but – to a larger extent – on the environment for which they gained their expertise.

Another author who stresses the importance of the environment is Ken Hammond (2015), who advocates the methodological imperative that cognitive processes (including intuition) should be studied using a *representative design*. The notion of representative design has been developed by Egon Brunswik as an alternative to systematic design. The latter usually selects, often manipulates – and sometimes even artificially creates – stimuli in order to disentangle the causal influence of several factors that could impact the response of interest. This is what most of us do! Brunswik argued that the set of stimuli used in a study with a systematic design is most often not representative of the set of stimuli in the natural environment – to which people's cognition has adapted. His alternative, representative design, can be implemented by sampling stimuli representatively of the environment, for instance, by randomly sampling (for an overview of representative design, see Dhimi, Hertwig, & Hoffrage, 2004). Brunswik's work suggests that the Lady is, well, easy to deceive. If we gain experience in a natural environment but are subsequently brought into an environment which is not representative of our natural environment, the Lady may still speak to us – but we might be better off not to listen since the inference mechanisms that have developed in a representative environment might lead us astray in a study that used a systematic design.

In his article for this special issue, Hammond adopts a historical perspective and reflects on the origins and receptions of representative design. It is hard to imagine a better author for this topic. Hammond was the last living student of Brunswik and in his essay he takes us back to the very beginning of his career – back to the 1940s at the University of California, Berkeley – but then covers six decades of debate centering upon the concept of representative design, thereby discussing the work of Gerd Gigerenzer, Daniel Kahneman, Phil Tetlock, and others. Unfortunately, we had to start the previous sentence with “Hammond was”. On April 28, 2015, he passed away at a “biblical” age of 98 after a career spanning seven decades of theoretical and empirical contributions to the field of judgment and decision research. The present paper is for sure one among the last (if not *the* last) he has written. We feel extremely glad and honored that we can include it in this

special issue, and we believe he would be delighted as well if he could see the context (i.e., the other papers) in which his essay appears.

The last of the 17 articles of the special issue that we want to highlight in the present overview with its focus on links to the work of Egon Brunswik is co-authored by Dhami, Belton, and Goodman-Delahunty (2015). It focusses on the middle-ground between intuition and analysis, in general, and on the role of quasirationality (as they call this middle-ground; see above) in sentencing decisions in the context of court trials, specifically. How should a particular case or person, ideally, be evaluated: by stepping back, abstracting from details, and applying legal rules in an objective manner, or by getting closer, seeing the specifics and using personal, eventually, intuitive judgment? Mandeep Dhami et al. (2015) look at both the legal system and at the actors in this system: They review how sentencing in common law jurisdictions in Australia, in the US, and in England and Wales is regulated and prescribed. As it turns out, none of these legal systems resembles one of our extremes; they all strike the balance between analysis and intuition, albeit with some variation and different tendencies towards the one or the other extreme. Moreover, the authors also study how decision makers – judges, jurors – actually function and decide in these legal environments, thereby addressing the question whether or not there is a place for our Lady in Black in a legal environment.

In closing, we want to express our gratitude to all the authors who contributed to this special issue. We hope this collection of papers, with its numerous links to the work of Egon Brunswik, will receive the attention of many readers and will stimulate thinking about and discussion of this unknown and elusive, but surprisingly familiar Lady in Black.

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**Applying Brunswik's Lens Model towards
our Understanding of Calibration in Driving**

William J. Horrey

*Liberty Mutual Research Institute for Safety, MA,
USA*

Contact: william.horrey@libertymutual.com

In the course of our daily lives and work, we selectively attend to available information (environmental cues) and we render judgments about the state of the world. We also carry out - sometimes immodestly - self-appraisals, evaluating how skillful or capable we are in different contexts. Both of these perceptions, of the world around us and of our own efficacy and ability, can have important implications concerning our decision-making and consequent behaviors. From a safety perspective, it is critical to understand situations where perceptions or subjective appraisals deviate from objective reality (i.e., gaps). One can readily imagine a fatigued driver electing to drive onwards, because he fails to adequately recognize the signs of fatigue or over-estimates his ability to persevere. The gaps in subjective and objective measures have been related to calibration - a concept that has been broadly studied in many disciplines (e.g., Zell & Krizan, 2014).

In a recent paper, we proposed a conceptual framework for understanding and studying calibration in the context of road safety (Horrey et al., 2015). While a complete accounting of the model is well beyond the scope of this article, we highlight a few of the relevant features in the hopes that interested readers will be encouraged to read the complete account. The model expands and elaborates on earlier models of demand regulation in driving (e.g., Fuller, 2005) as well as attention-based models of information processing (e.g., Wickens & Hollands, 2000). Models of demand regulation have been useful in articulating the regulatory process in which the driver balances the momentary assessment of ability and the assessment of demand. Further, modeling the role of attention in supporting various stages of information processing affords a mechanism for elaborating how attention allocation policies support information selection and processing. Because we can only process so much information at any given point, the proposed framework incorporates a mechanism through which different information cues are selectively attended and weighed in rendering appraisals or judgments. Thus, the lens model is a critical component of the framework in respect to information selection and utilization (e.g., Brunswik, 1955; Hammond, 1955). In our model, two lens models are used to conceptualize: (a) how observers utilize information cues in the local environment to understand the current situation and (b) how observers selectively attend to information cues about their own ability and skills.

In Horrey et al. (2015), we further describe the conceptual model in the context of three example areas in road safety: (a) our understanding of driver distraction, (b) the potential role and influence of in-vehicle automation and autonomous vehicles, and (c) the training of inexperienced drivers. In each of these areas, examining the

gaps between drivers' understanding of self (and additionally in the case of automation, of system) and the actual situation as it is presented can carry some important ramifications for safety and efficiency. In elucidating the interplay between models of attention, demand regulation, and lens modeling of information selection and utilization, we hope that the conceptual framework will be useful in guiding research efforts concerning the role of calibration in driving as well as in many other domains.

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Studying Vocal Emotion Communication from a Brunswikian Perspective

Georg Hosoya

Freie Universität Berlin, Germany

Tanja Bänziger

Mid Sweden University, Sweden

Klaus R. Scherer

University of Geneva, Switzerland

Contact: Georg.Hosoya@fu-berlin.de

Inferring the emotional state of a communication partner is an important aspect in order to achieve functional social interactions. The classical lens model equations (*LME*) allow for assessing the voice characteristics or cues that are utilized to attribute a certain emotional state to a sender. In addition, the ecological cue validity, as well as the achievement of the observer, i.e., the ability to infer the correct state from the cues, are determinable.

In a recent publication (Bänziger et al., 2015), we extended this perspective by applying the tripartite emotion expression model (*TEEP*, see Scherer, 2013) to the domain of vocal emotion communication using the statistical technique of path analysis. The assumptions of the *TEEP* model are that a sender's state is expressed by a number of objectively measureable distal cues. In the domain of vocal communication, these cues are represented by the acoustic characteristics that can

be extracted from the vocal signal via acoustic analysis. The listener perceives these distal cues as proximal percepts that can be assessed by using the Geneva Voice Perception Scale (*GVPS*, Bänziger et al., 2014). In the last stage of the model, proximal percepts are utilized to form a subjective judgment of the sender's emotional state.

One important feature of the *TEEP* model is that it allows for studying different stages of the vocal communication process simultaneously. Analyzing the relationship between a sender's state and the distal acoustic measures allows for studying the means that are used by the sender to express a certain emotion (expression). The relationship between the acoustic measures and the proximal percepts reflect the mapping of the objectively measurable voice characteristics to the perceived voice characteristics (transmission) and finally the cue utilization is represented by the relationship between the proximal percepts and the perceived emotion (impression).

In a series of studies that have been recently published (Bänziger et al., 2015), emotion portrayals were selected from two corpora generated in Munich and Geneva (see Bänziger et al., 2010). Anger, sadness, fear, happiness and arousal were target emotions. Eight acoustic parameters (distal cues), as well as their subjectively judged counterparts (proximal percepts) and ratings of the emotional content of the portrayals (perceived emotion) were included in the analyses.

The *TEEP* analysis resulted in four path diagrams that allow for an assessment of the emotion communication process from the expressed emotions via the distal cues and proximal percepts to the perceived emotion. In addition it was possible to determine the amount of mediation from the expressed emotion to the perceived emotion through the different stages of the model.

The highest amount of mediation through the *TEEP* model's stages occurred for arousal, followed by anger, fear and sadness. The fact that not all of the correct inferences were mediated through the model's stages suggests that not all of information that was used to correctly infer an emotional state was captured in the acoustic measures and proximal percepts. This leads to the conclusion that additional and more sophisticated measures that capture the acoustic information in the signal in the objective and subjective stages of the model are needed to map the inference process comprehensively.

We also performed hierarchical regression analyses to assess the amount of variance gained in the perceived emotions, once the proximal percepts have been entered into the regression equations. The results indicate that once the perceived emotions had been accounted for by the subjectively judged voice characteristics, the acoustic measures do not provide much additional information with regard to the subjectively judged emotions.

Comparing the *TEEP* analysis with the traditional *LME* approach, we find that the *TEEP* model provides a more integrative view of the communication process. It is to be expected that in future the pairing of advanced statistical techniques, such as multilevel latent variable modeling with probabilistic functionalism results in new approaches to the study of human perception and performance.

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**Bringing Ecology into the Usability Lab
Using the ECOVAL Framework**

Suzanne Kieffer*Université catholique de Louvain, Belgium***Jean Vanderdonckt***Université catholique de Louvain, Belgium**Contact: suzanne.kieffer@uclouvain.be*

This contribution for the Brunswik Society Newsletter 2015 builds on Kieffer et al. (2015), a paper initially intended for a Human-Computer Interaction (*HCI*) audience which presents *ECOVAL*, a framework for supporting ecological approaches in usability testing.

Usability is defined as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use” (ISO 9241-11, 1998). The context of use refers to four components: the user of the product, the task being performed by users, the tool being used to perform the tasks, and the environment in which such interaction takes place (Shackel, 1991). Whereas usability studies task-based interactions and focusses on the ability of users to achieve their goals efficiently and intuitively, the User Experience (*UX*) rather focusses on how users feel when they interact with a product. Formally, *UX* is defined as “a person's perceptions and responses that result from the use or anticipated use of a product, system or service” (ISO 9241-21, 2009).

Usability testing is a usability evaluation method in which experimental participants execute some tasks with a computer system representation in order to achieve some goals. It aims at measuring the usability of a product by collecting usability metrics such as task success, time on task, errors, etc. Thereafter, the *UX* can be measured by combining usability metrics and *UX* metrics such as heart rate variance, stress, self-reported emotion, etc. Usability testing is really a key milestone towards successful *UX*, as it structures and optimizes the design, prototyping and evaluation processes involved in the product development lifecycle by giving insight

into the findings and providing reliable information to the decision makers (Tullis & Albert, 2013).

The primary motivation for developing *ECOVAL* lies in the need for representative design in usability testing, i.e., the need for representing important aspects of the ecology toward which generalizations are intended (Dhami et al., 2004; Hammond, 1998). While the focus of Kieffer et al. (2015) was the representativeness of stimuli used in usability testing, we present the *ECOVAL* framework here (Figure 1) as an adaptation of Brunswik's lens model (Brunswik, 1956). The expression of the product in the usability testing situation (Figure 1, central grey area) is broken down into six actual traits (distal cues) which correspond to six perceived traits (proximal cues). Perceived traits are exploited by users to infer the product's state, develop a mental model for how it is supposed to work, and elaborate and apply a response to use it. User's motor and emotional responses with the tested product reflect the usability of the product when employed in its intended context of use. Ecological validity in *ECOVAL* refers to the correlation between the perceived traits and the usability of the product in its intended context of use.

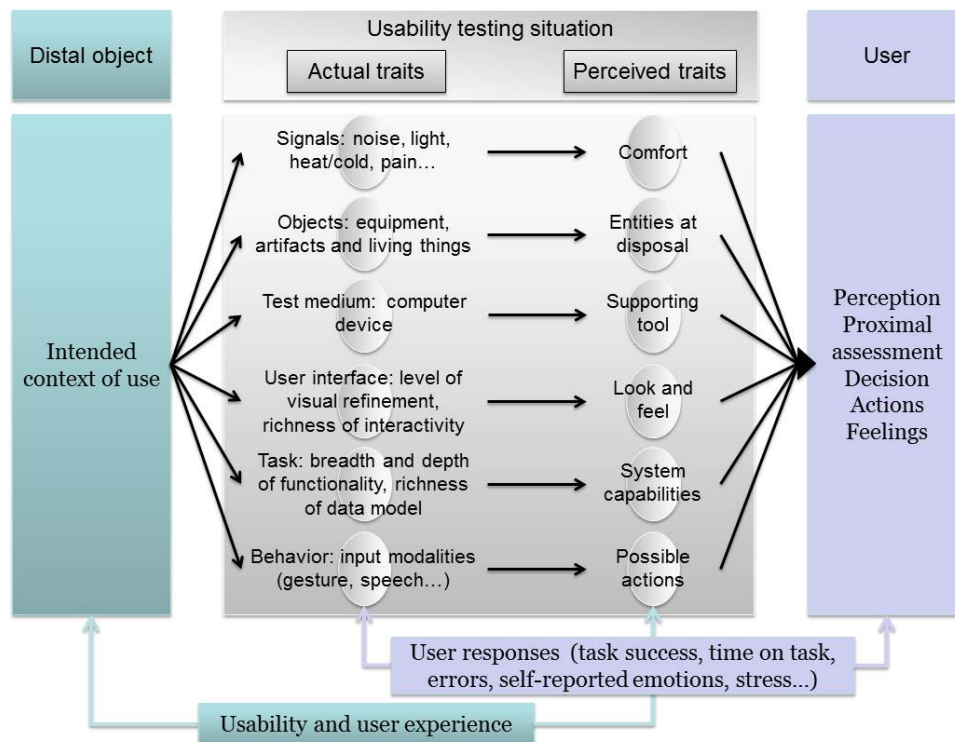


Figure 1. The ECOVAL framework as an adaptation of Brunswik's lens model.

An example of the utilization of *ECOVAL* is provided in the Figure 2. In this case study, the mission of the usability team was to computerize paper-based procedures for the inspection of a production line in a factory. A usability test was conducted early in the design phase so as to detect and fix usability problems, and produce the next version of the prototype.

Distal object	Usability testing situation	
	Actual traits	Perceived traits
Intended context of use		
Negative environmental factors disturbing human activities (dark, noise, risk of accident)	Usability lab (light, calm, safe)	Positive environmental factors promoting concentration and recreation
Fabric, production line, control rooms, equipment, colleagues, equipment to be inspected	Fabric, meeting room, mock equipment (simplified representation) to be inspected	Full range of entities at disposal to perform inspection tasks
Smartphone	The very smartphone the system is intended to run on	Smartphone
Real product user interface Fully interactive	Mock-up Clickable	Real interactive system look and feel
Breadth: 3 features Depth: 5-10 screens Data model: real-world data	Breadth: 1 feature Depth: 5-10 screens Data model: sample data	System capabilities: complete and relevant data to perform inspection tasks
Gesture-based interaction performed for real	Gesture-based interaction performed for real	Possible actions: partial range of touch gestures + typing

Figure 2. Example of use of ECOVAL in an industrial case study.

ECOVAL is, we believe, a significant contribution for the *HCI* community. Firstly, it clarifies the concept of ecological validity. In Brunswikian discourse, “ecological validity” refers to the correlation between a cue and the ecological criterion, and thus it is used to compare the quality of different cues and to understand why judgment based on such cues must have limited accuracy. In the *HCI* community, however, the term ecological validity refers to representativeness. In fact, it has been used by the *HCI* community with different meanings, making it a very confusing concept. It tacitly can refer to fieldwork (Carter et al., 2008), real-life or naturalistic conditions where experimental tasks are performed with high levels of fidelity (Castro et al., 2011), or studies “where subjects are totally unaware of being tested, testing is performed during their natural activity on the web” (Guerini et al., 2012). Secondly, it provides usability and *UX* professionals with an operational framework to achieve representative design in usability testing. Finally, an industrial case study (Kieffer et al., 2015) demonstrated the relevance of conducting usability testing with representative design early in the development lifecycle. Specifically, this enabled the early detection of usability problems that would have remained overlooked otherwise, and therefore increased both user and organizational efficiencies. In particular, operating low-fidelity prototypes (clickable mock-ups) on the very device the system was intended to run on enabled the detection of usability problems that remained overlooked with paper-based prototypes. This also highlighted the influence of the test medium chosen to conduct usability on the user experience, user responses and user behavior.

The representativeness of study designs, and of stimuli and their intercorrelations, and the ecological validity of perceived traits, need to be further investigated in order to complete the *ECOVAL* framework with guidelines for adequately achieving representative design according to the phase in the product development lifecycle.

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The Sound of Power: Conveying and Detecting Hierarchical Rank through Voice

Sei Jin Ko

San Diego State University, USA

Contact: sjko@mail.sdsu.edu

This article is based on recent research (Ko, Sadler, & Galinsky, 2015) where we used Brunswik's Lens Model as a framework to investigate how hierarchical rank is manifest through speakers' paralinguistic cues and whether listeners' use those cues to make accurate inferences of the speakers.

Cue-based person perception research has tended to focus predominantly on the perceiver with little or no consideration of the target person from where the cues originate. This imparts the erroneous impression that cues are invariant across situations and between targets. The advantage of utilizing Brunswik's Lens Model is that it does not allow for such a one-sided consideration.

Left side of the lens: Hierarchy-based vocal cues communicated by speakers

For the left side of the lens, which represents how vocal cues of hierarchy are communicated, we recorded 161 young adult speakers (80 males) fluent in English. When speakers first came into the laboratory, we first recorded their baseline voice. Following this, the speakers were randomly assigned to role-play one of several roles

that were either high-rank or low-rank. Speakers were recorded a second time reading a standard passage while in their respective roles.

For each speaker, we calculated six acoustical properties; once for the baseline voice and a second time for the hierarchical role voice. This allowed us to distinguish the impact of situational hierarchy from baseline dominance via controlling for the baseline acoustics in all of our analyses.

The measured acoustics were the mean pitch, variability in pitch, mean resonance, variability in resonance, mean loudness, and variability in loudness. Over and above baseline levels and speaker sex, we found that speakers' voices in the high-rank roles had higher pitch, more variability in loudness, and were more monotone (i.e., less variable in pitch), compared to low-rank roles.

Right side of the lens: Hierarchy-based vocal cues utilized by perceivers

In order to examine whether perceivers are able to make accurate inferences about speakers based on the acoustic cues, we had 40 perceivers listen to the speakers' role recordings and make hierarchy-based inferences about the speakers. There were two measures of hierarchy-based inferences. One was more subjective in that the items focused on behaviors that are likely to be distinct between those in high versus low rank (e.g., *How likely is it that this person is in a position to reward others?*). The other was a more objective dichotomous identification of speakers' rank level (i.e., high or low). We also investigated the specific acoustic cues that formed the basis of these inferences.

The results showed that perceivers were able to make accurate behavioral judgments based solely on vocal cues. Specifically, over and above speaker sex, speakers' who had been in the high-rank condition were rated as more likely to engage in high- than low-rank behaviors whereas speakers who had been in the low-rank condition were rated as more likely to engage in low- than high-rank behaviors. Perceivers were also significantly more accurate than chance in identifying speakers' rank level. Perceivers used increases in pitch, loudness, and loudness variability to make accurate inferences about speakers' assigned roles.

Achievement: Bringing the left and right sides of the lens together

To complete Brunswick's Lens Model, we examined overall achievement. In particular, we assessed the mediating role of the acoustic cues in the relationship between the left and right sides of the lens. We found that the hierarchy-based acoustic differences exhibited by speakers partially mediated the relationship between speakers' actual rank and perceivers' inferences of speakers' rank.

Some final thoughts

One of the most intriguing aspects of utilizing Brunswick's Lens Model has been how naturally it underscores the importance of considering distal and proximal cues. In our work, the distal cues are the acoustic cues as they are originating from the speakers. The proximal cues are the auditory perceptions of the acoustic cues. The "...objectively measured distal cues are not necessarily equivalent to the proximal cues they produce in the observer. While the proximal cues are based on (or mimic) distal characteristics, the latter may be modified or distorted by (1) the transmission channel (e.g., distance, noise) and (2) the structural characteristics of the perceptual organ and the transduction and coding process" (Scherer, 2003, p. 230).

Consequently, the associations between individual distal and proximal cues do not always yield high ecological validity. Importantly, however, the beauty of our perceptual field is that "...the low ecological validity of single cue variables...may be compensated for...by the use of multiple systems of mutually substitutable, or "vicarious", cues" (Brunswik, 1966, in Wolf, 2005, p. 488). Hence, individual cues that yield low ecological validity can contribute just as importantly to the overall achievement (defined as functional validity) as those that yield high ecological validity.

In our Lens Model, we found that speakers used pitch variability to communicate rank but perceivers did not use it to infer rank. Perceivers used loudness to infer rank but speakers did not use it to convey rank. Thus, the distal cue change in pitch variability may have produced the proximal cue change in loudness. In other words, this inconsistency in the distal and proximal cues played a part in achieving functional validity. According to Brunswik (1952) without such inconsistencies in the distal and proximal cues, functional achievement may have failed.

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Special Issue and Call for Commentaries: Modeling and Aiding Intuition in Organizational Decision Making

Julian N. Marewski

University of Lausanne, Switzerland

Ulrich Hoffrage

University of Lausanne, Switzerland

Contact: Julian.Marewski@unil.ch

Dear colleagues,

We like to draw your attention to a special issue on "*Modeling and Aiding Intuition in Organizational Decision Making*" (Marewski & Hoffrage, 2015) that recently appeared in the *Journal of Applied Research in Memory and Cognition* (JARMAC; <http://www.sciencedirect.com/science/journal/22113681>), and we solicit commentaries on the articles and opinion pieces published in this issue.

In this special issue, a total of 17 articles pull together diverse approaches to intuition, including naturalistic-decision-making, heuristics-and-biases, dual-

processes, ACT-R, CLARION, Brunswikian approaches, and Quantum-Probability-Theory. They use various methods (computational models, experimental and observational work, laboratory and naturalistic research), they cover various domains (consulting, investment, law, police, and morality), and they relate intuition to implicit cognition, emotions, scope insensitivity, expertise, and representative experimental design. Moreover, in our introductory article, we relate intuition research to historical, societal, and philosophical poles such as Enlightenment-Romanticism, reason-emotion, objectivity-subjectivity, inferences-qualia, Taylorism-universal scholarship, dichotomies-dialectics, and science-art.

The *contributors* to this special issue include several founders of influential research programs on intuition, four former presidents of the Society of Judgment and Decision Making (including the first two), a contemporary of towering Psychologist Egon Brunswik, and various former or current editors of general and specialized psychology journals (e.g., Psychological Review, Judgment and Decision Making, Decision).

In addition to soliciting the usual type of scientific *commentaries* (e.g., extensions, critique, praise), we would, first and foremost, like to encourage commentaries that make and leave the reader curious, and in doing so, help her to create and shed light on the mystery of what is commonly called “intuition.”

The articles, including our introductory article with its somehow unusual style and perspective and with its overview of the entire issue (Hoffrage & Marewski, 2015a; see also 2015b), are *open access* and can be downloaded here: <http://www.sciencedirect.com/science/journal/22113681/4/3>.

I. Introduction:

1. *Ulrich Hoffrage & Julian N. Marewski*
Unveiling the Lady in Black: Modeling and aiding intuition.

II. Experience, Expertise, and Environments:

2. *Gary Klein*
A naturalistic decision making perspective on studying intuitive decision making
3. *James Shanteau*
Why task domains (still) matter for understanding expertise
4. *Kenneth R. Hammond*
Causality vs generality: Judgment and decision making struggles to become a scientific discipline

III. Formal Models and Cognitive Architectures:

5. *Robert Thomson, Christian Lebiere, John R. Anderson, & James Staszewski*
A general instance-based learning framework for studying intuitive decision-making in a cognitive architecture
6. *Ron Sun*
Interpreting psychological notions: A dual-process computational theory
7. *Ion Juvina, Christian Lebiere, & Cleotilde Gonzalez*
Modeling trust dynamics in strategic interaction

IV. Prescription, Aiding, and Rationality:

8. *Rex V. Brown*
Decision science as a by-product of decision-aiding: A practitioner's perspective
9. *Robin Hogarth & Emre Soyer*
Providing information for decision making: Contrasting description and simulation
10. *Lee C. White, Emmanuel M. Pothos, & Jerome R. Busemeyer*
Insights from quantum cognitive models for organizational decision making

V. Sentencing, Valuation, and Moral Judgments:

11. *Mandeep K. Dhami, Ian Belton, & Jane Goodman-Delahunty*
Quasirational models of sentencing
12. *Stephan Dickert, Daniel Västfjäll, Janet Kleber, & Paul Slovic*
Scope insensitivity: The limits of intuitive valuation of human lives in public policy
13. *Martina Raue, Bernhard Streicher, Eva Lermer, & Dieter Frey*
How far does it feel? Construal level and decisions under risk
14. *Jonathan Baron, Sydney Scott, Katrina Fincher, & S. Emlen Metz*
Why does the Cognitive Reflection Test (sometimes) predict utilitarian moral judgment (and other things)?

VI. Intuition in the Wild:

15. *Sylviane Chassot, Christian A. Klöckner, & Rolf Wüstenhagen*
Can implicit cognition predict the behavior of professional energy investors? An explorative application of the Implicit Association Test (IAT)
16. *Shanique G. Brown & Catherine S. Daus*
The influence of police officers' decision-making style and anger control on responses to work scenarios
17. *Thorsten Pachur & Melanie Spaar*
Domain-specific preferences for intuition and deliberation in decision making

If you are interested in writing a commentary on one or several of these articles, please send us (Julian.marewski@unil.ch, Ulrich.Hoffrage@unil.ch, with cc to the journal's editor-in-chief Ron Fisher, fisherr@fiu.edu), **before January 10th, 2016**, a short summary of your proposal (about 1/4 page). We will then decide, before January 15th, whether (or not) we invite you to submit a full commentary. Invited commentaries should be submitted by February 29th. If you anticipate that you will need more time to write your commentary than the 6 weeks we can grant you, we kindly ask you to submit us your ¼ page commentary proposal any time between today and January 10th. If your commentary proposal convinces us on the spot, we will immediately invite you to submit a full commentary, which will give you more time until the submission deadline.

The final version should ultimately fit two journal pages (which amounts to a maximum of approx. 1,800 words, including references), but we are able to offer more space if we can be convinced that readers will likely feel their time to be well-spent.

Julian Marewski & Ulrich Hoffrage

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News from the Past Year

Jeryl L. Mumpower

Texas A&M University, USA

Contact: jmumpower@tamu.edu

I just completed my third year as Division Director for Social and Economic Sciences at the U.S. National Science Foundation. As I indicated last year, it was a most interesting and challenging experience and I believe I was able to make a contribution to our sciences, but it certainly had an adverse effect on my ability to get research done. I am now back at my home institution, Texas A&M University and hope to rejuvenate my research program a bit.

I did publish three papers this year, but none of these had a distinctly Brunswikian theme. My colleagues Xinsheng Liu and Arnie Vedlitz published a paper in the *Journal of Risk Research* on psychometric and socio-demographic predictors of the perceived risk of climate change. And I published two papers with Mike Lindell and his graduate students relating to risk perception and protective action decision making in water contamination emergencies. (Mike and I were both graduate students at the same time with Ken Hammond in Boulder, long, long ago.)

On a more Brunswikian note, Tom Stewart, Jim Holzworth and I continue working, albeit at a snail's pace, on our next paper stemming from our research program investigating how people make selection and detection decisions (e.g., how they to decide whether to hire someone or whether a patient has a disease) in the face of uncertainty and different feedback conditions.

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**Cross-Classified Structural Equation Models
for the Analysis of Lens Model Data**

Steffen Nestler

University of Münster, Germany

Mitja D. Back

University of Münster, Germany

Contact: steffen.nestler@wwu.de

An important asset of Brunswikian research is that human behavior is analyzed both by an idiographic and a nomothetic approach. Whereas the idiographic approach focuses on dynamics within the single individual (e.g., how accurate a specific perceiver is, how much this perceiver uses a given cue), the nomothetic approach tries to find general laws across persons (e.g., how accurate perceivers are in general, how much a given cue is generally used). To consider both approaches in data analyses, lens model researchers typically take a two-step approach: First, a respective parameter, such as agreement or the utilization of a cue, is computed for each single judge. Second, these single-judge parameters are then used (a) to provide idiographic statistical information (e.g., the variance of the single-judge parameters), (b) nomothetic statistical information (e.g., the average of the single-judge parameters), or (c) information concerning a specific research question (e.g., effects of perceiver personality on accuracy and individual cue usage) by employing a more complex statistical approach (e.g., regression models, univariate and multivariate ANOVAs, path models, etc.).

The two-step approach however is statistically problematic as a single-judge parameter (e.g., the agreement coefficient of judge *i*) is always an estimate of the true single-judge parameter (e.g., the true agreement coefficient of judge *i*). It thus contains both the true population parameter and error. When the second-step approach fails to take into account this error, the standard errors of the second-step analysis approach, for example, are probably not trustworthy. To overcome these problems, we suggest using cross-classified structural equation models instead (CC-SEM; see Nestler & Back, in press).

In a CC-SEM, the single judge's data is simultaneously analyzed. This allows a researcher (1) to obtain statistically sound measures on the idiographic level of analysis (e.g., individual differences between perceivers in agreement or cue utilization) as well as the nomothetic level (e.g., the mean agreement or the mean cue utilization). The model can be used (2) to examine variables that may explain variations in agreement or cue usage. Also, a researcher can test (3) whether observable cues mediate the agreement of judgments or (4) whether the strength of valid cue usage depends on certain characteristics of the judges. Finally, the model allows a researcher (5) to explicitly model measurement error when there is more than one indicator for the criterion or the judgment. For a straightforward application

of these kinds of analyses we provide R and Mplus syntax files that can be easily adjusted for one's own research questions and data (see <https://osf.io/zyx4w/>).

In summary, CC-SEMs unify the idiographic and nomothetic levels in the analysis of lens model data. Furthermore, a number of additional and interesting research questions can be answered allowing us to more deeply delve into the fascinating Brunswikian world.

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Nestler, S., & Back, M. D. (in press). Using cross-classified structural equations models to examine the accuracy of personality judgments. *Psychometrika*.

Error Parsing: Implementing Social Judgment Theory in the Units of Judgment

Daniel M. Oppenheimer
University of California, Los Angeles, USA

Crystal C. Hall
University of Washington, USA

Contact: daniel.oppenheimer@anderson.ucla.edu

For over 50 years Social Judgment Theory (*SJT*) has proven to be a tremendously useful tool for analyzing judgment and helping judges improve their performance. *SJT* is primarily concerned with four key pieces of information: 1) the predictability of the environment (i.e., how well environmental cues correlate with the outcomes a judge is trying predict), 2) the knowledge of the judge (i.e., how accurately a judge weights the environmental cues in making a prediction), 3) the “control” of the judge (i.e., how consistently a judge weights the environmental cues in making a prediction), and 4) the overall achievement of the judge (i.e., how well the judge's predictions correlate with the outcomes the judge is trying to predict). By providing judges with feedback on these four things, decision scientists have been able to help people make better estimates.

Historically, these four constructs were measured using correlational methods. This makes a great deal of sense; correlation is the most natural way of measuring the relationship between two continuous variables (such as examining the extent to which an environmental cue predicts an outcome). Moreover, many of the studies using *SJT* have used abstract scales (such as Likert Scales) which do not cleanly map onto real world, measurable units.

However, often judgments are not made on abstract scales – such as when one is trying to estimate the price of a car, the number of calories in a snack, or the number of people who will be displaced by a hurricane. In such cases, feedback in the form of correlation coefficients may be hard to interpret and apply. Feedback in absolute units (e.g., dollars) may be more useful. Moreover, there are times when

identical correlation coefficients can represent drastically different amounts of absolute error. For example, {1,2,3,4} correlates perfectly with both {1,2,3,4} and {7,8,9,10} but the absolute magnitude of difference in the latter is much greater than in the former.

To address these issues, we introduce Error Parsing, a method of *SJT* that makes use of absolute magnitude rather than correlations. By taking insights from the Bootstrapping literature and combining them with the logic of *SJT*, Error Parsing provides outputs in the units of judgment. Especially for people who don't have much statistical training, correlation coefficients may be difficult to make sense of and incorporate into subsequent predictions. Moreover, unlike correlation, which can obscure the magnitude of difference, in Error Parsing absolute magnitudes are straightforward and obvious. (For another way of removing biases due to correlations, see Stewart & Lusk, 1994.)

Of course, more traditional forms of *SJT* are still better than Error Parsing under many circumstances. For example, correlation (and thus *SJT*) is better for reducing deviation from ordinal rankings – a situation where Error Parsing requires a number of (unlikely to be true) assumptions to be valid. Error Parsing is much more suited for reducing absolute differences in error. For interested scholars, our paper “Error Parsing: An alternative method of implementing social judgment theory” in the September issue of the *Journal of Decision Making*, includes a complete description of the Error Parsing methodology, a comparison of the outputs of *SJT* and Error Parsing on real data sets, and an analysis of when Error Parsing is more (or less) effective than more traditional *SJT* approaches.

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The Uses and Abuses of the Coherence – Correspondence Distinction

Andrea Polonioli

University of Edinburgh, Edinburgh, UK

Contact: a.polonioli@sms.ed.ac.uk

My paper “the uses and abuses of the coherence – correspondence distinction” was recently published in *Frontiers in Psychology*. As its title suggests, the article traces the historical development of Hammond’s suggested distinction and discusses its role in debates over human rationality. Here I summarize its main message.

Kenneth Hammond’s distinction between coherence and correspondence has been used to frame important debates in psychological research. Consider, in particular, that in recent decades research on judgment and decision-making has witnessed the development of several different approaches to human rationality, which differ in terms of the importance they attribute to traditional normative models and the adaptiveness of behaviour in the assessment of performance (e.g., Chater & Oaksford, 2000; Gigerenzer et al., 1999; Kahneman & Tversky, 1972). Whilst these different projects have arguably remained somewhat disconnected, Hammond (1990, 1996, 2007) has attempted to remedy this balkanization. To promote cross-fertilization between different lines of research, he first tried to outline a framework that could allow him to identify different strategies available to us in the study of human judgment. Hammond’s distinction between coherence and correspondence criteria of rationality was central to his project and hence offered as a powerful tool in the study of judgment and decision-making. The latter strategy is called correspondence “because it evaluates the correspondence between the judgment and the empirical fact that is the object of the judgment” (Hammond, 2007, p. 16). Coherence, on the other hand, relates to the fit between people’s judgments. Specifically, Hammond (2007, p. 16) defines coherence as “the consistency of the elements of the person’s judgment.” According to him, “it is easy to see the difference between a judgment that is directed toward coherence – make it all fit together – and one that is directed toward the correspondence between a judgment and a fact” (Hammond, 2007, p. 19).

Armed with this distinction, Hammond tried to make sense of different lines of research in the study of human judgment. On one extreme, Brunswik’s (1956) research offered a prominent illustration of work on correspondence. His research focused entirely on empirical accuracy, which comes down to the correspondence between a judgment and an object. On the other extreme, Hammond argued that research in the heuristics and biases tradition provided a paradigmatic example of research on coherence (Gilovich et al., 2002). Whilst the heuristics and biases project was motivated by a desire to offer accurate descriptions of human judgment and decision-making and give insight into underlying mechanisms and processes, its researchers measured behaviour against a set of normative principles. For example, subjects are said to violate coherence when they commit the conjunction fallacy,

ranking the conjunctive event A and B as higher in probability than one of its component events (see, e.g., Tversky & Kahneman, 1983). Hammond concluded that this distinction proved useful in categorizing research in the field. Yet, he was aware that, while correspondence refers here to empirical accuracy, a criterion with which we are all familiar, providing a specific characterization of coherence would be a daunting task.

Notably, Hammond's suggested distinction has been widely used in the field and it has been widely recognized as a useful conceptual tool in the study of judgment and decision-making (Adam & Reyna, 2005; Baron, 2012; Lee & Zhang, 2012; Mandel, 2005; Newell, 2005; Wallin, 2013). It was also celebrated in 2009 in a special issue of the journal *Judgment and Decision Making*. Yet, as my paper seeks to show, the relevant notions of coherence and correspondence have been progressively considered to be too narrow and have undergone non-trivial conceptual changes since their original introduction.

I try to show, first, that the proliferation of different conceptualizations of coherence and correspondence has created confusion in the literature and that appealing to such notions has not helped to elucidate current discussions over the nature of rational judgment and decision-making. Nevertheless, I also argue for a reframing of the debate. In fact, what seems to underlie several contemporary appeals to the notions of coherence and correspondence is best explained in terms of a contrast between what I call rule-based and goal-based rationality. Whilst these categories do need further refinement, they do seem to be useful for organizing and understanding research on rational judgment and decision-making.

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The Legacy of Brunswik's Representative Design in the 21st Century: Methodological Innovations for Studying Everyday Life

Mariona Portell

Universitat Autònoma de Barcelona, Spain

M. Teresa Anguera

University of Barcelona, Spain

Antonio Hernández-Mendo

University of Málaga, Spain

Gudberg K. Jonsson

University of Iceland, Iceland

Contact: mariona.portell@uab.cat

It is an honor to have been invited to contribute to the Brunswik Society newsletter in relation to our recent paper "Quantifying biopsychosocial aspects in everyday contexts: An integrative methodological approach from the behavioral sciences" (Portell, Anguera, Hernández-Mendo, & Jonsson, 2015). The article reviews the shared properties and requirements of different methods and techniques for quantifying biopsychosocial aspects in everyday contexts and proposes a general framework for integrating them.

In our paper, we address methods for studying biopsychosocial aspects in natural settings in real time and on repeated occasions. According to the majority of these methods, researchers must necessarily sample observations from environmental contexts as well as from populations of participants if they are to effectively capture psychosocial phenomena. Readers of the Brunswik Society Newsletter will undoubtedly know that these methods follow the logic of Brunswik's concept of representative design, but we firmly believe that it is necessary to explicitly make this connection in other publications.

Hammond (1998a) summarizes the complicated times during which Brunswik had to justify, apply, and defend the representative design approach, which called into question the methodological "ideology" of the time. Difficulties related to technological limitations are progressively being overcome, and the explosion of information and communication technologies has facilitated the application of the representative design approach and led to methodological innovations seeking to quantify biopsychosocial aspects in everyday contexts. We believe that the viability and increasing visibility of these methods constitute an opportunity to pay tribute to Brunswik's contributions, which was precisely our intention when writing our paper. We hoped to contribute to reinforcing the link between the representative design approach and later innovations, such as the experience sampling method and similar methods for studying psychological phenomena in natural settings. Although not all

texts that trace the historical roots of these modern-day methods mention Brunswik's contributions, fortunately many do. We would like to draw particular attention to Hogarth's (2005) work and to take this opportunity to thank him for guiding us in our own approach to Brunswik's methodology.

Our approach to daily life research methods emphasizes three key points in relation to studies designed to provide evidence for evaluating complex interventions, and in particular, implementation fidelity (Portell, Anguera, Chacón-Moscoso, & Sanduvete, 2015). The first point is the relatively little value still attached to the efforts invested in studies involving the direct observation of behavior in natural, everyday settings. In our paper, we describe a number of remarkable methodological innovations that have emerged despite the difficulties, and in addition we propose a series of classification criteria for research methods for studying everyday life, including observational methodology (Anguera, 1979). The second point is related to the importance of tools for studying behavior as patterns that occur over time. Intensive recording of events and behaviors, combined with appropriate statistical methods, has made it possible to uncover time patterns "hidden" within the data (Magnusson, 1996). The third point we stress is the importance of avoiding methodological dogmatism and of choosing the most appropriate method for each case. Although the research methods and techniques we review in our paper offer many benefits for the study of everyday life, we strongly advocate the complementary use of different designs and approaches to enhance the validity of the research. However, even though a variety of methods can provide robust evidence for particular interventions or psychological principles, this evidence is likely to be ignored as long as randomized clinical trials remain the gold standard for evaluating psychological interventions (e.g., Carey & Stiles, 2015).

Finally, we would like to take this opportunity to mention something that got lost during the "pilgrimage" of our paper through different journals. In the published version, we do not mention the fact that Brunswik used the term "ecological validity" with a different meaning from that commonly understood today. We nonetheless share the concern about the threat that polysemy poses to the development of psychology as a cumulative science. The implications of this conceptual confusion have been discussed by Hammond (1998b) and by Dhami, Hertwig and Hoffrage (2004), cited in our paper.

Despite the above challenges, we are hopeful that the different efforts to enhance the connection between Egon Brunswik's methodological innovations and research methods being using to study everyday life in the 21st century will contribute to the development of a truly cumulative psychological science.

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Egon Brunswick's Psychology in Terms of Objects: From Alexius Meinong to Arne Naess

Jan Radler

Europa-Universität Viadrina, Germany

Contact: jan.radler@web.de

History and Philosophy of Science (HOPOS) has recently become a research program of its own. A precursor and a sideline of this research is the investigation of the history of Logical Empiricism in all of its ramifications. It is widely known that Egon Brunswick was associated with Logical Empiricism, but he was not a "Logical Empiricist" in a narrow sense. Moreover, he was influenced by his Viennese teacher, Karl Bühler, who represented a different approach.

Although Bühler was Brunswick's main influence on the development of his psychological research program, another Austrian thinker is also important. In a recent paper (Radler, 2015), I showed how Alexius Meinong's notion of a forum of perception triggered the idea that perception must be conceptualized as a process, which is necessarily embedded in an environment. In explaining perception, external constituents must be included.

As already noted in the literature (e.g., Wieser, 2014), Fritz Heider, Meinong's last PhD student, provided Brunswick with an important inspiration for his "lens model". Perception must be regarded as a mediated process. Thus, a direct line of intellectual inheritance can be drawn from Meinong's "forum" (Meinong, 1906) and Heider's "medium" (Heider, 1920; 1927/1959) to Brunswick's "lens" (Brunswick, 1934). Whereas Heider is ambivalent because the "medium" is necessary but also influences and therefore disturbs the perception of the object, Brunswick avoided this tension. Brunswick's avoidance does not indicate that he is a Meinongian. On the contrary, he is skeptical of the metaphysical stance of Meinong (Brunswick, 1934, p. 3, note 1). Brunswick had no interest in establishing a new philosophical theory of everything, but had rather more modest inclinations to establish a "scientific" psychology. The term "scientific" means to be in accord with the demands of "physicalism" to the effect that every scientific term must be translatable into a "physical" term. This holds also for psychology (Neurath, 1933/1992). Clearly, Brunswick here is in accord with Logical Empiricism. Brunswick took the position of Otto Neurath, who persuaded his peers to agree with him. Brunswick's "psychology in terms of objects" is mainly a physicalistic research program (Brunswick, 1934, p. 214, note 1; Brunswick, 1937).

Another line of research is followed in Radler (2013). The Norwegian philosopher Arne Naess was – in his early years – strictly in agreement with Otto Neurath. In his magnum opus (Naess, 1953), Naess coined the idea of a depth of intention to denote the degree of precision of a formulation. The idea of a depth of intention is important for two reasons. First, in the protocol-sentence debate, Neurath suggested using imprecise formulations on which most people in a debate can agree (congestions, Ballungen). A too-precise formulation will not help to foster scientific cooperation, and science is, for Neurath, a cooperative endeavor. Therefore, a term's low depth of intention is desirable. Second, later in the 1970s, Naess formulated the "deep ecology" approach, that is, an attempt to provide solutions to the environmental problems of our planet. "Deep ecology" cannot be understood without taking Naess's empirical semantics into consideration (Howe, 2011).

Deep ecology must be understood, as I have showed, as a platform of discussion and cooperation for all of those who are engaged with environmental issues. One can see how this echoes Neurath's idea of a unified science. Additionally, Naess clearly had Brunswik's notion of "Intentionstiefe" (depth of intention, Brunswik, 1934, p. 102) in mind when he worked on his empirical semantics. In general, one can find Brunswikian traces in all of Naess's writings.

In sum, these studies show that Brunswik's research into perception left traces where nobody would expect them – in Naess's empirical semantics and even in his deep ecology. My research can be read as a proposal to consider J. J. Gibson's ecological psychology anew. Historically, theories of perception from Meinong, Heider, Bühler and Brunswik are mediated and indirect but nevertheless externalistic. On this topic, further research is welcome.

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Solving Asymmetric Decision Situations

Lars Sjö Dahl

University of Lund, Lund,
Sweden

Contact: lars.e.sjodahl@gmail.com

Different knowledge-systems

A recent doctoral thesis (Skoog, 2015) presented at Lund University studied indications for drug treatment. This population study comprised 77,978 elderly patients' charts. On average only 45.1% of the patients had correct diagnoses, i.e., indications for drug treatment. Of the patients who used anti-psychotic drugs only 18% (467 of 2,601) had indications for these drugs. The author comments on these findings as follows: "On average, less than half of the described drugs had indications for treatment. ... It is alarming that so few of the prescribed drugs had correct indications" (ibid, Paper IV, p. 8.). Some retroactive first person evaluation of psychiatrists' chart notes have revealed a shocking lack of idiographic, patient-specific information in combination with drug descriptions (Sjö Dahl, 2004, 2012). This unmotivated use of drugs, in particular antipsychotic drugs is a threat to the patients' quality of life and their capacity for recovery and functioning (Sjö Dahl & Kaufmann, 2008).

Asymmetric decision situations

How to handle asymmetric decision situations, where one party holds on to inside information not accessible to the other party, has been studied by the economists Akerlöf, Spence and Stiglitz (Harford, 2006). We may learn from them how to cope with asymmetric decision problems like diagnostic situations where both parties, doctor and patient, due to their different knowledge systems (focal versus tacit, idiographic versus nomothetical) have their own inside information, not fully accessible to the other part. Based on the three economists' suggestions we propose the following three guidelines to overcome the asymmetry between the diagnosing psychiatrist and his/her patient in order to improve the validity of psychiatric diagnostics: 1) Patient and psychiatrist should agree about common goals like relief of symptoms, protection of the patient's mental assets and a planned follow-up of the patient's quality of life; 2) The person with inside information should become skilled in communicating it to the other person in a way that the latter trusts; 3) The person without the partner's inside information should become skilled in uncovering it in a trustworthy way. These three fundamental principles for solving asymmetric decision situations raise a question: Are psychiatrists and their patients skilled in mutually communicating and uncovering their respective inside information in a diagnostic decision situation? Some indirect information, relevant for our question, can be found within nursing research studying interpersonal relations between psychiatric ward personnel and their patients (Reed & Fitzgerald, 2005; Ross & Goldner, 2009). According to these reports it seems likely that neither ward personnel nor patients are trained for dealing with mutually asymmetric decision situations. Here the validity of patients' chart notes as well of psychiatric diagnoses is at risk.

Coherence or correspondence criteria

According to Tape (2009): "The field of medicine historically focused on coherence arguments and only recently has attention been focused on correspondence approaches.... Even today coherence arguments carry enormous weight in justifying medical therapies.... Practicing physicians often use coherence arguments to explain their judgments" (pp. 134-135).

A wicked way of solving a mutual, asymmetric decision situation by group-coherence consists of one part being forced to completely assimilate the other part's inside information at expense of giving up his/her own inside information. This actually happened in a Swedish psychiatric hospital (Day, 2012; Porter, 2015). The patient, who called himself Thomas Quick, completely assimilated the therapists' ideas about repressed memories. "During all therapy sessions and police reconstructions Quick was heavily drugged on a cocktail of benzodiazepines. Medical records show that he was being given tablets every couple of hours- often up to 20 mg of diazepam" (ibid). Altogether Quick confessed to more than 30 murders and was declared guilty of 8. Today all these verdicts are reversed. The turning point came with the publication of a book based on interviews with Quick, where he was given the opportunity to reveal his own inside information, verified by correspondence criteria (Råstam, 2012). In the preface to this book Leif G. W. Persson, Professor of Criminology, writes: "This is a book which tells us what happened when Swedish police, prosecutors, and lawyers, with willing support from some doctors, psychologists and a so-called memory expert, crowned a mentally ill mythomaniac as the worst serial killer in the history of crime" (ibid, p. 13) (Author's translation). The extensive governmental report (SOU, 2015, p. 52) sums up: "Within this group there seems to have developed group thinking and an ambition to reach coherence" (ibid, p. 16). (Author's translation)

The need for cooperation between clinician and patient in psychiatric diagnosis has been emphasized in an earlier contribution to the Brunswik Society Newsletter as follows: "That diagnostic inference, or labeling, always should be made within the context of environmental and personal factors implies that clinicians and patients must find ways to cooperate with the purpose of improving the clinician's feedback situation and at the same time establish a trustful, lasting alliance, making alternative treatments, beside drug prescriptions, possible" (Sjödahl & Kaufmann, 2009).

The three premises mentioned above for successful solutions of asymmetric decision situations probably apply to all levels of social organization and when violated the outcome could be lamentable as the following poem illustrates:

PLAYING MARBLES

We played marbles on the square one day, a small schoolboy and me. I had about 50 and he had 5.

We played and he lost.

He sniffled and threw me a look when I whistled in a superior manner and walked away.

But I regretted it when I got to our street-door and felt I'd done something bad.

I hurried back but nowhere could anyone tell me where the schoolboy could be found.

I felt ashamed, and still feel so, when I see schoolboys playing marbles.

And I'd give anything, I don't know how much, to see that schoolboy happy again.

But now he's surely a big, stout man, slaving away – I don't know where.

And if I did know – it wouldn't help – you can never right your wrongs.

You can never give marbles back and console boys who have frozen into men.

(Selander, 1926). (Author's translation).

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Measuring Momentary and Retrospective Soundscape Evaluations in Everyday Life by Means of the Experience Sampling Method

Jochen Steffens

Max-Planck-Institute for Empirical Aesthetics, Frankfurt, Germany

Daniel Steele

*McGill University, School of Information Studies & CIRMMT, Montreal
Canada*

Catherine Guastavino

*McGill University, School of Information Studies & CIRMMT, Montreal
Canada*

Contact: jochen.steffens@web.de

This contribution for the Brunswik Society Newsletter is an adapted version of the conference paper of Steffens, J., Steele, D. and Guastavino, C. (2015). New Insights into Soundscape Evaluations Using the Experience Sampling Method. Proceedings of Euronoise 2015, Maastricht, Netherlands.

Listening to our acoustic environment takes time. One way a sound “persists” through time is when it is perceived and remembered by listeners. Any expressed evaluation of an acoustic environment necessarily makes use of retrospection, whether we are still in the environment or remembering one from our childhood. The influence of cognitive processes, especially memory representations of a temporal experience, may lead to a weighting of certain episodes in the course of an overall retrospective evaluation.

Previous research in the field of decision-making psychology has shown that momentary (i.e., “in-the-moment”) judgments of time-varying experiences do not always match retrospective judgments (e.g., “Peak-end rule” by Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993). Laboratory studies by Västfjäll (2004) and Steffens and Guastavino (2015) suggest that retrospective judgments of environmental sounds are also affected by cognitive biases such as the recency or the trend effect. Furthermore, mood is shown to have an overall effect on sound evaluations and on a participant’s preference for sound (e.g., Västfjäll, 2002). Methodological issues, however, raise the need to extend the investigations to longer and more eventful sound periods, to remove the laboratory and investigator from the context, and to also take into account situational variables. One method that allows the measurement of peoples’ reactions in everyday situations and associated time scales is the so-called Experience Sampling Method (*ESM*). *ESM* refers to a method of data collection in which people periodically make momentary judgments over the course of the day while going about their everyday activities (Csikszentmihalyi, Larsson, & Prescott, 1977). The *ESM* is in line with Brunswik’s (1947) concept of a representative design of experiments that allow the sampling of stimuli from the person’s natural environment which are representative of the population of stimuli to which the person has adapted. Brunswik further highlighted the importance of

understanding how various psychological factors function and interact in different real-life situations.

Thus, the aim of our study was to extend the validity of existing findings to soundscape. According to a recent ISO definition (2014), soundscape is “the acoustic environment as perceived or experienced and/or understood by a person or people, in context”. We hypothesized that daily retrospective judgments of soundscape pleasantness are governed by the average of the momentary judgments obtained over the course of the day, the linear trend, the positive and negative peaks (maximum and minimum values), and the end (last measuring point). We finally assumed an influence of the person's mood while making the retrospective judgment.

32 participants, 17 women and 15 men with a mean age of 28.8 years (SD = 5.6), participated in the study. They were recruited via mailing lists for current students, postdocs, faculty and staff of McGill and via Craigslist. 80.8% of the participants were students; the rest (19.1%) had a job outside the university. Participants were recruited on the basis of having an Android smartphone that they regularly carried with them. Those who did not have an Android phone but who wished to take the study were provided with an alternate device.

In total, three different questionnaires were presented in this study. One questionnaire was designed to report momentary judgments of the soundscape over the course of the day and occurred at 10 near-random times per day. Amongst others, this “momentary form” contained the question on soundscape pleasantness (“How do you rate the pleasantness of the soundscape?”). This question had to be answered on a 7-step Likert scale ranging from unpleasant (1) to pleasant (7). The second form used in the study was the “daily summary”. In this questionnaire, participants were requested to perform retrospective judgments of the whole day (e.g., “How do you rate the pleasantness of the soundscape(s) over the whole day?”) using the same seven-step Likert scales as for the momentary judgments. Participants were also asked to report on their current mood (from bad (1) to good (7)). The third and last form employed was the “weekly summary” which provided overall retrospective judgments of soundscape pleasantness over the course of the whole 7-day period. However, within this contribution, only the relationship between momentary and daily retrospective judgments will be presented.

Since the aim of the study was to investigate which features of the momentary judgments contribute to the retrospective judgments of a day, a linear mixed model was calculated. In this calculation, the average, the maximum (“Peak (max)”) and the minimum value (“Peak (min)”) occurring over the course of a day as well as the last measuring point (“End”) of the momentary judgments were considered potential independent variables of the daily summaries. Additionally, the linear trend over the course of the day was computed. It is the standardized regression coefficient of a linear regression analysis with the independent variable time. Finally, the retrospective pleasantness judgment obtained in the daily summary was considered the dependent variable.

The calculation of the linear mixed model (covariance matrix: compound symmetry) revealed four fixed effects predicting the daily retrospective judgments: the average, the linear trend, the negative peak (Peak (min)), and the mood of the person while making the judgment. The regression statistics are reported in Table 1.

The results of our study confirm our assumption that retrospective judgments of soundscape pleasantness are not only governed by “cognitive averaging” processes but also by specifically unpleasant peak moments.

Table 1

Mixed Models Analysis of the Relationship of Retrospective Judgments and Features of the Momentary Judgment - Estimates of Fixed Effects

Variable	Estimate	Std. Error	t	Sig.-Level
Intercept	.66	.51	1.28	.20
Average	1.00	.13	7.74	.00
Trend	.53	.16	3.25	.00
Peak(min)	-.18	.07	-2.50	.01
Mood	.32	.07	4.37	.00

Moreover, the results provide further empirical evidence that judgment processes in auditory perception are influenced by a person's mood and anticipation how the soundscape experience might go on (derived from the linear trend). This is, to a large extent, in line with the literature mentioned above. However, neither a significant effect of the last measuring point (recency effect) nor of the positive peak was found. This can be explained by a theoretical overlap of the trend and the recency effect (e.g., Loewenstein & Prelec, 1993). It therefore can be assumed that the recency effect did not explain further variance beyond that already explained by the linear trend. We further did not observe an effect of the positive peak (in contrast to a significant effect of the negative peak), which might be due to a negativity bias. This effect indicates that, based on predispositions and experience, negative events receive greater weight compared to equivalent positive events (Rozin & Royzman, 2001).

Two limitations associated with the method have to be addressed. Since no variables were experimentally varied within the study and relationships are only observed on a correlational basis, the *ESM* does not allow the researcher to draw definite conclusions about causal relationships. Furthermore, the *ESM* is time-consuming, expensive, and demanding for both the participant and the researcher. However, the *ESM* proves to be a promising method to investigate the perception and evaluation of our acoustic environment in an ecologically valid context as inspired by Brunswick's idea of a representative design.

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Brunswik's Representative Learning Design Informs Integrated Video-Ball Projection Technology

Joseph A. Stone

Sheffield Hallam University, UK

Keith Davids

Sheffield Hallam University, UK

Jamie S. North

St. Mary's University, Twickenham, UK

Derek Panchuk

Australian Institute of Sport, Australia

Contact: Joseph.Stone@shu.ac.uk

In the study of human movement behavior, two critical features of Egon Brunswik's ideas on representative design are *functionality of the task* and *action fidelity* (Brunswik, 1956). Functionality of the task refers to people being able to use information sources that are representative of those available in performance environments. Therefore, when researchers design experiments they should ensure that perceptual variables available in a performance environment are maintained in empirical work, so that behaviors examined during experimental tasks can be generalized to a performance environment. This functionality must also be combined with *action fidelity*, which refers to performers being able to organize the same types of actions that would be required in actual performance environments. This article summarizes a series of experiments, using a custom-built integrated video and ball projection technology (see Stone et al., 2014a), on performance of dynamic interceptive actions, to study visual anticipation and interceptive actions underpinned by the ideas of Brunswik's (1956) representative learning design.

In human movement experiments it has traditionally proven difficult to maintain both *functionality* and *fidelity*. In experiments investigating interceptive actions such as catching, using a "live" thrower to project an object means having the same individual available to perform the projection action throughout extended periods of experimental data collection, which can lead to a number of issues such as costs, time demands, or potential repetitive strain injury. A "live" performer can also introduce unintended variability into the projection action, potentially introducing a source of error across experimental conditions or participants. Some of these

limitations can be overcome by using traditional ball projection machines for relatively stable ball flight trajectories to be maintained over trials without incurring injury risk, costs or inordinate time demands on skilled individuals to “deliver” the ball to participants. Yet this type of ball projection technology means advanced perceptual information from a thrower’s actions is no longer available. Consequently, functionality is not provided in experiments, since participants are not exposed to the same perceptual information that would be available in a typical performance environment. Traditionally, some studies have used life-size images of a person projecting (e.g., throwing or striking) a ball with participants required to respond verbally or using pen and paper. Whilst this ensures that functionality of the task is achieved in a controlled and consistent manner, the inability of participants to use relevant behaviors, i.e., physically intercept the object, means that fidelity is not satisfied.

In order to achieve task functionality *and* action fidelity we developed a novel methodological approach that maintains information-movement coupling when studying performance of dynamic interceptive actions, such as ball catching. The apparatus combines video and ball projection technology which enables video images (e.g., of an actor throwing a ball) to be synchronized with a ball being projected from a hole in the screen. In this experimental design, participants are presented with advanced perceptual information from images of an actor (functionality) and are then required to intercept (catch or hit) a projectile (fidelity). Using this apparatus a series of empirical investigations have been undertaken to test Brunswik’s ideas on representative design, examining the significance of functionality and fidelity when designing experimental task constraints. Our experimental program has employed this integrated projection technology to study the relations between affordances and emergent behaviors in one-handed catching tasks, recording kinematic data, visual gaze behaviors, and measures of postural control in skilled and less skilled individuals (see Panchuk et al., 2013; Stone et al., 2014 a, b, c; Stone et al., 2015).

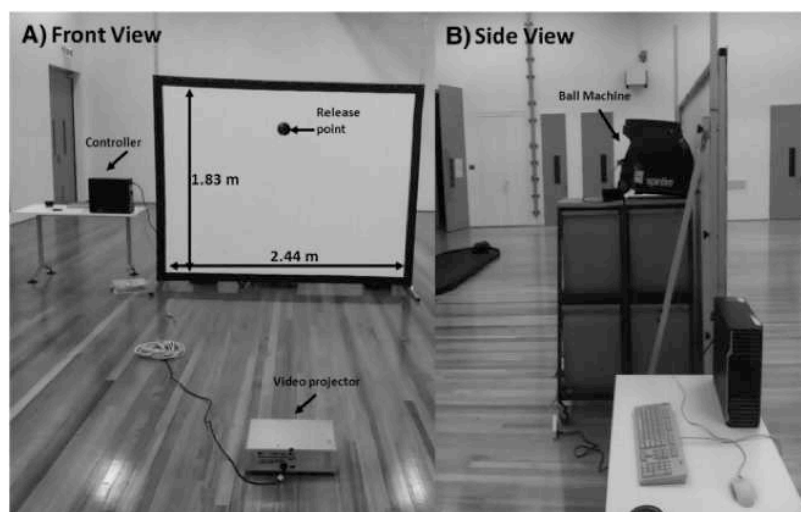


Figure 1. Taken from Stone et al. (2014a). The custom-built ball projection device and set-up showing a) front and b) side views.

The combined video and ball projection technology first resulted in improved catching performance (i.e., people successfully caught more balls) and showed more functional kinematic movement patterns of the catching hand compared to video or ball projection only conditions (Stone et al., 2014b). Gaze behaviors also changed, with visual tracking of the ball occurring earlier and lasting longer during the integrated condition compared to ball projection only (Stone et al., 2014b). Postural coordination behaviors were also shown to be dependent on the representativeness of informational constraints designed into experiments, with changes in postural control strategies observed when advanced visual information or ball trajectories were manipulated (Stone et al., 2014c). For example, when functionality of the task was altered (e.g., removal of video information of a 'thrower'), postural adjustments of the lower limbs occurred later compared to when visual information was available. When action fidelity was manipulated (participants used micro-movements to simulate catching actions without a ball being projected), smaller displacements were observed in lower limb angles, resulting in upward projection of the center of mass compared to a downward projection when fidelity was maintained (balls were projected and physically intercepted). The results highlighted the importance of representative designs which allow information-movement coupling to be maintained during performance of interceptive actions. Movement behaviors are continuously organized and adapted using both advanced kinematic information of an individual's actions and ball flight characteristics.

In conclusion, the series of experiments that we have conducted in this program of work are grounded in Brunswik's (1956) ideas on representative design. Developing a novel apparatus that combines video and ball projection, we demonstrated that experimental designs which fail to accurately represent performance environments result in less accurate performance of a primary task, less efficient and effective visual search behaviors and hand kinematics, as well as different postural control strategies in comparison to conditions that more faithfully represent the informational constraints of a performance setting. Our findings illustrate the combined importance of both *functionality of the task* and *action fidelity* when designing representative experimental settings. Egon Brunswik's ideas are still relevant today and continue to inform the design of experimental research and practice environments in human movement science, psychology, and sport pedagogy (Pinder et al., 2011).

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A New Audience?

Warren Thorngate

Carleton University, Ottawa, Ontario,
Canada

Contact: warren.thorngate@rogers.com

We scientists have an astonishing tendency to run madly off in all directions. The result is a rich mix of scientific fecundity and chaos. The fecundity ensures that our production of diverse, scientific knowledge far outpaces the attention required to consume it all. Chaos ensues as our prospective audiences pick and choose the tiny fraction they can consume of our productions. As collegial competitions for scientific attention multiply, members of our prospective audience become ever more likely to attend to what is popular or interesting than to what is elegant or important. Too often style defeats substance; substantial ideas sink into obscurity while their stylish competitors bask in the scientific spotlight.

I am thus heartened that the Brunswick Society does its best to keep the substantial ideas of Brunswick and his intellectual progeny alive. Safe to say these ideas are worth knowing. Sad to say they are known by too few. So it is worthwhile to seek new audiences.

I first became aware of Brunswick's limited audience while completing my 1971 dissertation on multi-cue probability learning, a venerable Brunswikian topic. My results showed that few people increased their judgment accuracy by learning cue-criterion relations; instead, most people increased their accuracy by learning memorable examples or prototypes and generalizing from these to their nearest neighbors. I vainly convinced myself that the finding had useful implications for teaching people how to improve their judgments through clever selection of case histories. Alas, the implications never caught on and they remain, as far as I know, in an unmarked graveyard of unexplored possibilities.

Still undaunted and freshly employed, I began to inculcate Brunswikian concepts into my captive audiences of social psychology students, repeating the inculcation for 40 years. Brunswick's Lens Model remained beautifully suited for organizing the vast literature on person perception, impression and social judgment, but I never found a social psychology textbook adopting the Lens Model for this purpose. Even now, the most popular textbooks in social psychology make few if any references to Brunswick, opting instead for mimetic, topical accounts of social psychology's mad run.

Yet opportunities for spreading Brunswik's ideas still emerge now and then, often from unlikely places. One of these can be found in a newish area of computer simulation called agent-based modeling. Agent-based modelers write computer programs simulating the actions and interactions of hypothetical people, called agents, represented as algorithms supposedly capturing real people's psychological processes or rules. The modelers then watch their agents interact, hoping to witness the emergence or transformation of group structure or dynamics, of cooperation, competition, and such. They then change the psychological rules and study the collective consequences of these changes. Examples of such agent-based modeling can be found in any issues of its best-known publication, the *Journal of Artificial Societies and Social Simulation*, JASSS.

When agent-based modelers program their simulations, they must decide which psychological rules to include. Alas, they often choose unrealistic or uncommon rules easily programmed rather than rules documented by our research. This has created a problem for modelers facing criticisms from funders and policy makers that their simulations are based on false assumptions.

What the world of agent-based modeling needs are some useful methods for assessing, in the real world, what psychological processes of making judgments and decisions the people they wish to simulate are using. I suggested three of these methods in a recent JASSS article (<http://jasss.soc.surrey.ac.uk/18/1/14.html>). Thanks to Brunswik, Ken Hammond and their many colleagues, one of the three is policy capturing; the other two, information seeking and social choice, are close cousins.

I am sure additional, policy-capturing methods inspired by Brunswik, Hammond and others would also be useful for agent-based modelers seeking to simulate the real world. So if you have developed or used any new and improved variant of policy capturing in your work, I encourage you to consider submitting an article about it to JASSS. A new and eager audience awaits your contribution. Spread the word!

Thorngate, W. (2015). Heads and hearts: Three methods for explicating judgment and decision processes. *Journal of Artificial Societies and Social Simulation*, 18(1), 14.

**Physician versus Nurse Judgment Policies
Regarding the Probability a Patient has a Clostridium Difficile Infection**

Bob Wigton

*University of Nebraska Medical Center, Omaha, Nebraska,
USA*

Contact: wigton@unmc.edu

I am still at the University, but have reduced my time to about 1/3. I'm enjoying the free time.

Currently I have been working with Nasia Safdar, MD, PhD, an infectious disease researcher, and her team at the University of Wisconsin. We are investigating differences between medical residents and nursing staff in how they use clinical cues to estimate the likelihood a patient has Clostridium difficile infection (which causes a serious diarrheal illness). We asked physician and nursing staff at a large teaching hospital in Wisconsin, USA, to judge the likelihood of C. difficile and whether tests for the organism should be run. In keeping with previous interviews, a one-sided lens model with 5 cues showed significant differences between the two groups, with nurses weighting stool odor highest and physicians, the white blood count (with minimal weight given stool odor). We are investigating further the reason for these differences and their impact on clinical management. In addition, we are building a model to study the policies of ancillary staff as well.

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